



Energy Storage Systems Program Overview

Energy Storage Systems Program Annual Peer Review November 14-15, 2001

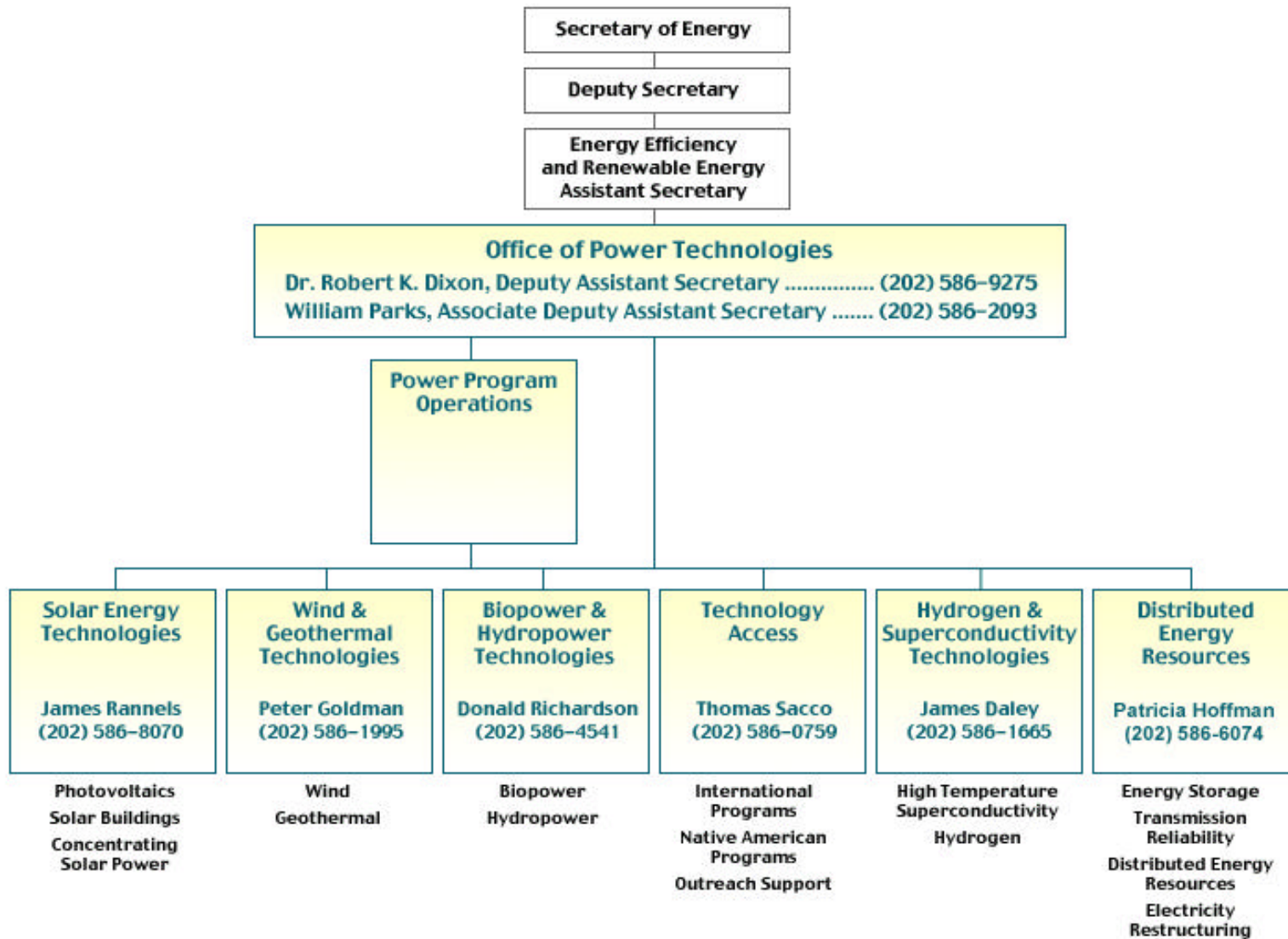
John D. Boyes
Sandia National Laboratories



Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy under contract DE-AC04-94AL85000.



DOE Organization Chart





Energy Storage Systems Program Mission

Develop advanced energy storage technologies that increase the reliability, performance, and competitiveness of generation, transmission, and distribution in the U.S. electric supply for both grid-connected and off-grid systems.



Energy Storage Systems Program Goals

- **develop and evaluate integrated energy storage systems**
- **develop batteries, SMES, flywheels, and other advanced energy storage devices**
- **improve multi-use power electronics, controls, and communications components**
- **analyze and compare technologies and application requirements**
- **encourage program participation by industry, academia, research organizations and regulatory agencies**

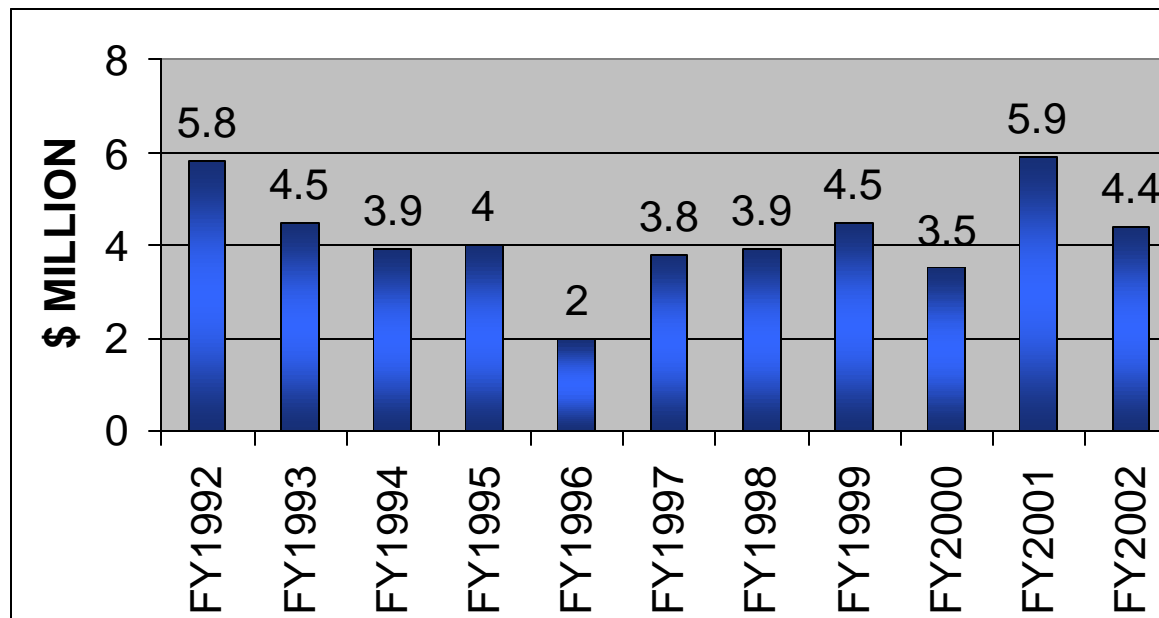


ESS Program Elements

- **System Integration**
 - pursues a strategy to reduce the inefficient, one-of-a-kind system engineering historically required when utility energy storage systems have been designed and built
 - evaluate and disseminate information on systems in the field
- **Subsystem Development** - develop and evaluate the components of the energy storage system to achieve lower cost, higher performance, and are better integration than currently available.
 - storage component (e.g., flywheel, battery, or SMES)
 - power conversion and control subsystems
- **Strategic Research** - formulation and application of analytical methodologies necessary to identify utility applications and estimate the technical and economic benefits of energy storage.



Energy Storage Systems Program Funding

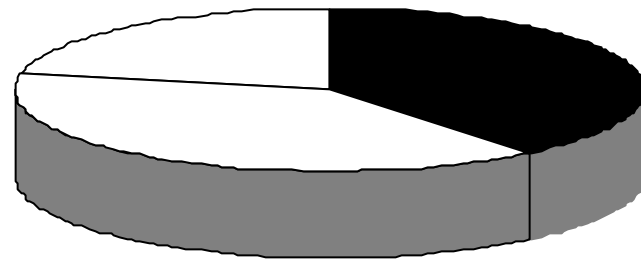




System Integration Projects

FY01 \$ 2.1 M

- Conceptual Design - Boulder City Project
- Univ. of Maryland DER/Battery System Study
- PV/Hybrid Systems Field Test at STAR
- Alternative RGS System
- Alaska Battery-Diesel System
- Zinc Bromine Flow Battery Tests
- Integration of FACTS Device with Storage
- Vernon & Metlakatla VRLA Battery Monitoring
- RAPS Testing Methods
- Peru RAPS System Study



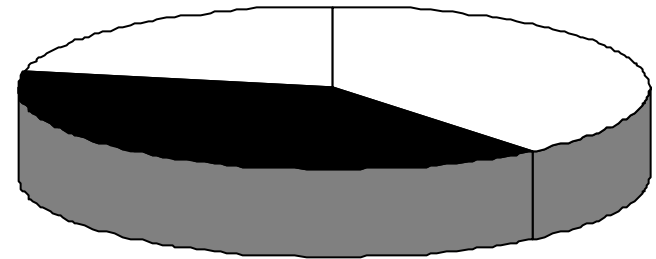
FY01 System Integration
Budget
37%



Subsystem Development Projects

FY01 \$ 2.2 M

- Superconducting Flywheel
- Li Ion Battery Module
- Optically Isolated HV-IGBT MW Inverter (SBIR)
- Advanced Intelligent Controller
- ETO switch development
- VRLA reliability improvement



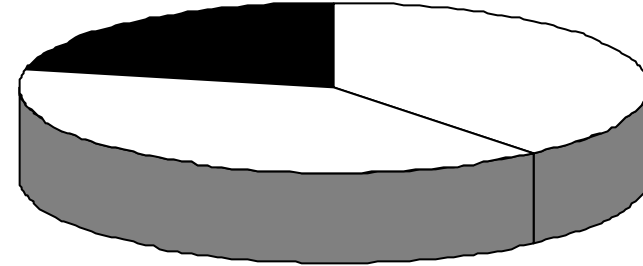
FY01 Subsystem
Development Budget
39%



Strategic Research Projects

FY01 \$ 1.4 M

- Secondary Use of EV Batteries
- Power Quality Events in Silicon Valley (HQ contract)
- Supercapacitor/Micro-turbine System Modeling
- Value of Reliability (HQ contract)
- Energy Requirements for a Digital Society (HQ contract)
- Value of Storage in Restructured Utility
- EESAT
- Reporting



FY01 Strategic Research
Budget
24%



FY01 Program Highlights

- **ETO**
 - Design for manufacturability complete and initial prototype produced
- **ZBB Zinc Bromine Battery completed two field tests**
- **Conceptual Design of 10 MWh Boulder City System**



FY01 Program Highlights

- **Transmission Power Quality Project Canceled**
 - Planned to monitor TPQ in South East Region of US
 - Several major Utilities declined to participate
 - Proprietary concerns
 - Occupied with regulatory and RTO activities
 - Did not see project value at this time
- **EESAT 2000 Conference**
 - 120 Attendees from 15 countries
- **Patent Disclosure Filed**
 - Optimal Management of Batteries in Electric Systems